Evaluation Plan for: 2023 Astrophysics Probe Explorer (APEX)

Announcement of Opportunity

NNH22ZDA015J

July 21, 2023

Outline

Introduction

Introduction

- The goal of this Evaluation Plan is to define the ground rules, processes, organizations, and schedules to be used in evaluating the proposals received in response to the APEX Announcement of Opportunity (AO).
- This Evaluation Plan covers evaluation information from the AO and from the evaluation processes conducted by the Science Panel and the Technical, Management and Cost (TMC) Panel.
- This Evaluation Plan describes step one of a two-step competitive process to down-selection for Phase B.
- The Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC) developed this APEX Evaluation Plan for the Science Mission Directorate (SMD) at NASA Headquarters.
- This Evaluation Plan has been cleared for public release by SMD.
- The Astrophysics Probe Program Lead Scientist is responsible for validating all evaluation processes, responsibility assignments, assumptions, and ground rules.

APEX Solicitation

- All investigations proposed in response to this solicitation must support the goals and objectives of the Astrophysics Explorers Program (Section 2), must be implemented by Principal Investigator (PI) led investigation teams (Section 5.3.1), must enable compelling broad community science investigations through a GO program for an APEX Pointed Observatory and/or a GI program for an APEX Survey Observatory (Section 2), and must be implemented through the provision of complete spaceflight missions (Section 5.2.1).
- The AO Cost Cap for an APEX mission is $1000M in NASA Fiscal Year (FY) FY2023 dollars (FY23$), not including the cost of standard launch vehicle and launch services or any contributions.
- An APEX investigation will be launched as the primary payload on a single launch vehicle (LV). NASA will provide standard launch services utilizing a domestic launch vehicle certified as category 3 per NPD 8610.7, *NASA Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions*. There will typically be a charge against the PI-Managed Mission Cost for any launch services beyond the standard launch services offered.

Evaluation Organization

Evaluation Panel

Dr. Patricia Knezek, Program Scientist
Science Mission Directorate (SMD), NASA Headquarters

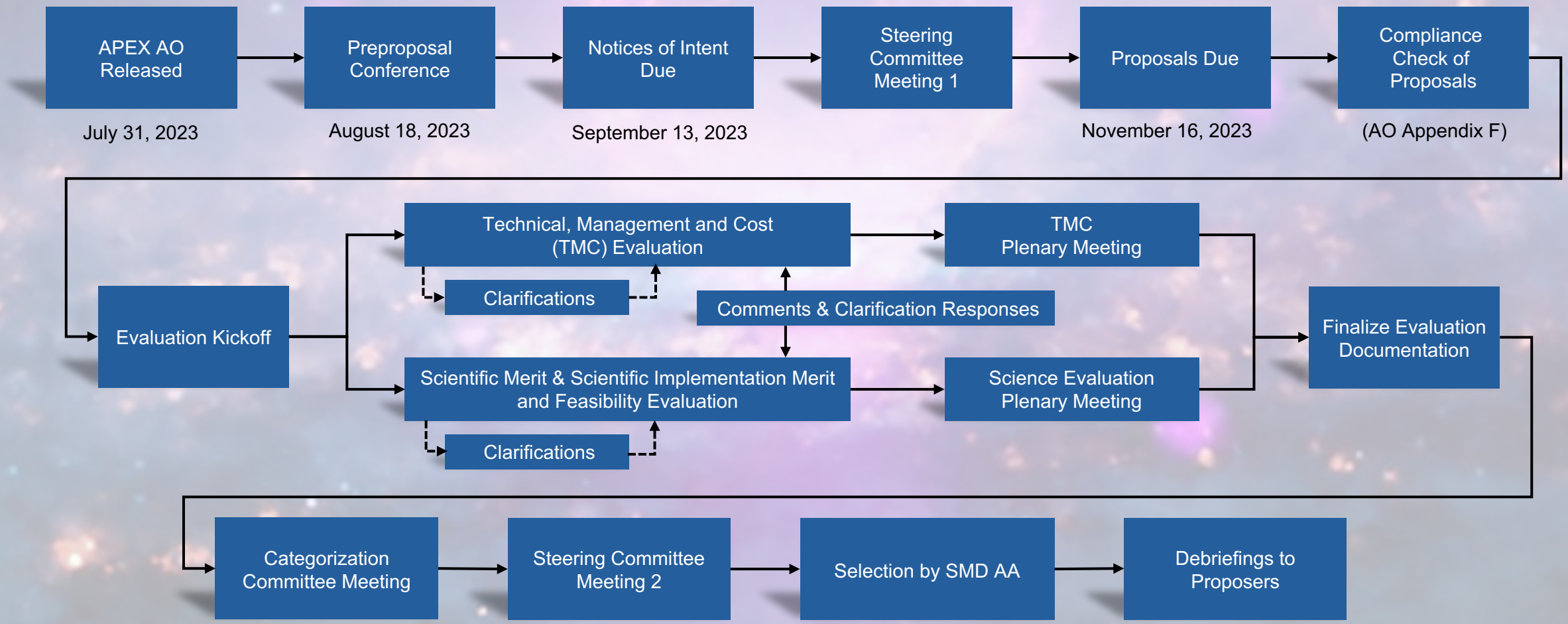
Science Evaluation Panel

Dr. Patricia Knezek, Program Scientist
Dr. Manuel Bautista, Deputy Program Scientist
Astrophysics Division, SMD

TMC Evaluation Panel

Victor Lucas, Acquisition Manager (AM)
Elisabeth Morse and Shelia Nash-Stevenson, Backup AMs
NASA Science Office for Mission Assessments (SOMA)

Proposal Evaluation Flow



Compliance Checklist, APEX AO Appendix F

Compliance Checklist

This is the list of items that NASA checks for compliance before releasing a proposal for evaluation. All other requirements are checked during evaluation.

Administrative:

1. Mandatory NOI submitted on time
2. Electronic proposal received on time
3. Augmented submission via the NASA Box service made on time
4. Meets page limits
5. Meets general requirements for format and completeness (max 5.5 lines per vertical inch, max 15 characters per horizontal inch, 12-pt font, 1-inch margins)
6. Required appendices included; no additional appendices
7. Budgets are submitted in required formats
8. All individual team members who are named on the cover page indicate their commitment through NSPIRES
9. All export-controlled information has been identified
10. Restrictions involving China acknowledged on Electronic Cover Page

Compliance Checklist (continued)

Scientific:

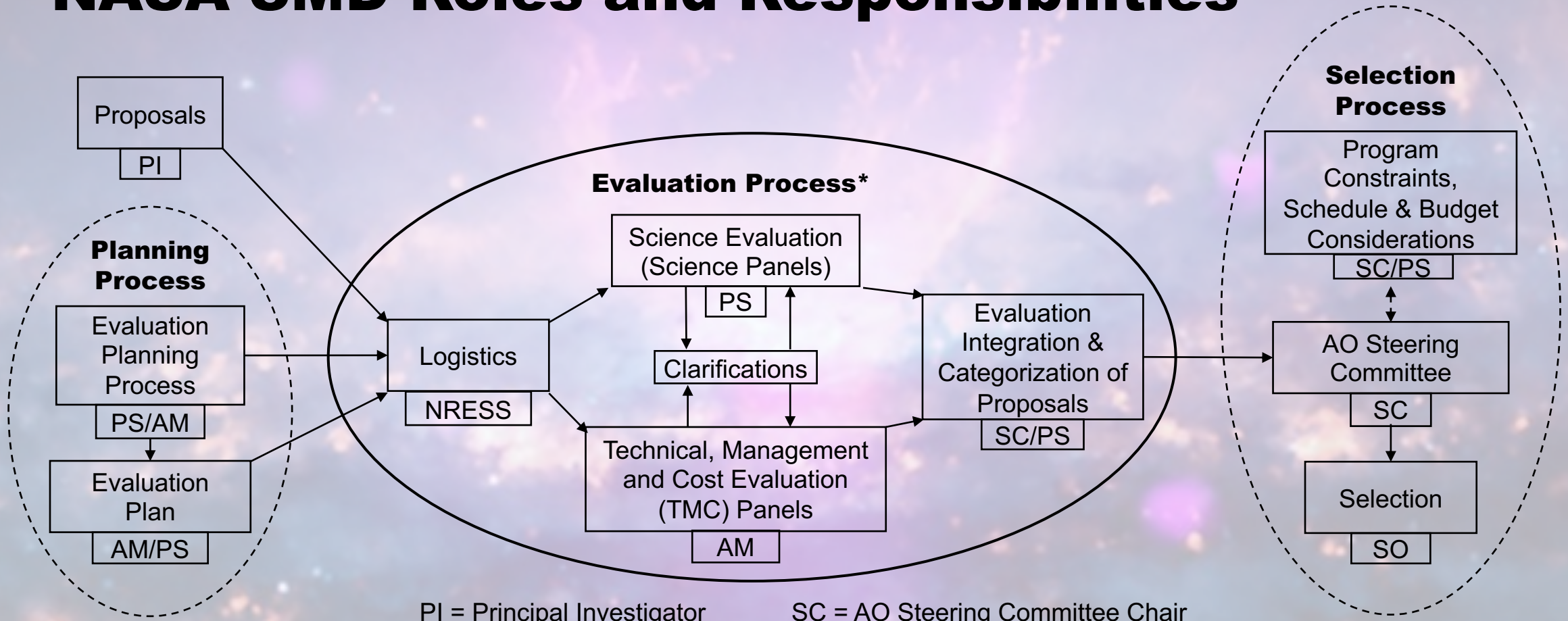
11. Addresses solicited program science objectives
12. Requirements traceable from science to instruments to mission
13. Data Management Plan included
14. Baseline and threshold science investigations defined

Technical

15. Complete spaceflight project (Phases A-F) proposed
16. Team led by a single PI
17. PIMMC within AO Cost Cap or Adjusted AO Cost Cap, as applicable
18. Phase A costs within Phase A cost limits
19. Co-investigator costs in budget
20. Proposed launch readiness date prior to AO-required launch readiness date
21. Includes table describing non-U.S. participants
22. Includes letters of commitment from funding agencies for non-U.S. participating institutions
23. Includes letters of commitment from all U.S. organizations offering contributions
24. Includes letters of commitment from all major partners and non-U.S. institutions providing contribution of efforts of anyone on the Proposal Team

General Evaluation Requirements

NASA SMD Roles and Responsibilities



PI = Principal Investigator
PS = Program Scientist
AM = Acquisition Manager
SC = AO Steering Committee Chair
SO = Selecting Official
NRESS = NASA Research and Education Support Services

** The Evaluation Process is addressed in this document.*

Pre-Evaluation - Steering Committee Meeting 1

- As part of the Evaluation Planning Process, before the evaluation process begins, an AO Steering Committee Meeting 1 will be convened. This Committee is composed of the SMD Deputy Associate Administrator for Research (DAAR) and a small number of SMD Program Scientists/Executives.
- The AO Steering Committee will conduct an independent assessment of the planned evaluation and associated processes regarding their compliance to established policies and practices, completeness, and self-consistency. They may provide recommendations to the Program Scientist and Acquisition Manager on potential adjustments to the evaluation team and the planned processes.

Conflicts of Interest (COI) Prevention and Mitigation Requirements

- The Science Panel members are on-boarded through the NASA Research and Education Support Services (NRESS) contractor, and the non-Civil Servants are provided an honorarium for their participation.
- The NRESS contractor cross-checks all the Science Panel members against the lists of personnel and organizations identified in each proposal submitted to determine whether any organizational Conflict of Interest (COI) exists.
- The non-Civil Servants TMC Panel members will be hired as contractors through the NASA Science Office for Mission Assessments (SOMA)'s Evaluations, Assessments, Studies, Services, and Support 3 (EASSS 3) contractor.
- The EASSS 3 contractor cross-checks all contracted TMC Panel members against the lists of personnel and organizations identified in each proposal submitted to determine whether any organizational COI exists.
- All evaluators must divulge any other financial, professional, or personal potential COIs, and whether they work for a profit-making company that directly competes with any profit-making proposing organization.
- All Civil Servant and Intergovernmental Personnel Act (IPA) evaluators must self-certify their COI status by reviewing a combined listing of individuals and organizations associated with the APEX proposals.
- The TMC evaluators must notify the SOMA Acquisition Manager in case of a potential COI. The Science evaluators must notify the Program Scientist in case of a potential COI.

Conflicts of Interest (COI) Prevention and Mitigation Requirements (continued)

- Community standards for conflicts of interest will be applied to all evaluators as directed in SMD Policy Document SPD-01A, *Handling Conflicts-of-Interest for Peer Reviews*. Under certain restricted situations, a waiver for SPD-01A, Section 2(b)(*v*) may be requested. Standards for financial conflicts of interest as specified in 18 U.S.C. § 208 will be applied to Civil Servant and IPA evaluators. The HQ Office of General Counsel will be consulted, as necessary.
- All known potential COI issues are documented, and a COI Mitigation Plan is developed to minimize the likelihood that an issue will arise in the evaluation process. Any potential COI issue is discussed with the Program Scientist and the SMD Deputy Associate Administrator for Research and documented in the COI Mitigation Plan. All determinations regarding possible COIs that arise will be logged as an appendix to the COI Mitigation Plan.
- If any previously unknown potential COI arises during the evaluation, the conflicted member(s) will be notified to stop evaluating proposals immediately, and the Panel Chair will be notified immediately. If a COI is confirmed, the conflicted member(s) will be immediately removed from the evaluation process, and steps will be taken expeditiously, to remove, mitigate, or accept any actual or potential bias imposed by the conflicted member(s). The steps will be documented in the COI Mitigation Plan.
- Members of the Science and TMC panels are prohibited from contacting anyone outside their panel for scientific/technical input, or consultation, without the prior approval of the Program Scientist. If authorized by the Program Scientist, the Deputy AA for Research should be notified.

Handling of Proprietary Data

- All proposal and evaluation materials are considered proprietary.
- Viewing of proposal materials will be only on a need-to-know basis.
- Each evaluator who is not a Civil Servant or IPA will sign a Non-Disclosure Agreement (NDA) that must be on file with the NRESS contractor or the EASSS 3 contractor prior to any proposals being distributed to that evaluator.
- Civil Servants and IPA evaluators are under statutory obligations and are not required to sign an NDA.
- A record will be kept of who has been supplied with what materials.
- Evaluators will be briefed at a Kickoff web conference on how to handle the proposal materials. Evaluators will be briefed that they are not allowed to discuss proposals with anyone outside the Evaluation Panels ever, unless authorized by NASA. Evaluators will be briefed to not contact anyone outside of the Evaluation Panels to gain insight on any proposal related matter without expressly getting authorization from the Program Scientist (Dr. Patricia Knezek).

Handling of Proprietary Data (continued)

- Any Observers at Review Panels will not have access to proposals or evaluation materials (See Slide 56 for more information).
- During the Evaluation, all proprietary information that needs to be exchanged between evaluators will be transferred securely via the Remote Evaluation System (RES) website maintained by SOMA, via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES), via the secure NASA's Box file transfer capability, via the secure ScienceWorks system maintained by SMD, via secure WebEx, via NASA's Google docs, or via encrypted email, parcel post, fax, or regular mail. Proprietary information will not be sent via unencrypted email.
- Web conferences or teleconferences among evaluators will be conducted via controlled Web conference and teleconference lines. Virtual meeting information is confidential. The meeting numbers and pass codes are posted in a file on the RES or on NASA's Google docs. Participants will be briefed to ensure they do not provide this information to anyone or distribute this information via unencrypted email or text messages.
- When the evaluation process is complete, proposals and evaluation materials will be deleted/destroyed. Some copies (for archival purposes) will be maintained at NASA HQ by the Program Scientist and in the SOMA vault. Also, all proposal material from the selected project(s) will be provided to the Explorers Program Office at NASA Goddard Space Flight Center (GSFC). All other proposal materials will be destroyed.

Principles for Evaluation

- All proposals are to be treated fairly and equally.
- Merit and Risk are to be assessed on the basis of the material provided in the proposal and through the clarification process.
- Evaluation Ratings shall reflect the written strengths and weaknesses.
- Everyone involved in the evaluation process is expected to act in an unbiased objective manner; advocacy for particular proposals is not appropriate.

General Evaluation Ground Rules

- All proposals are evaluated to uniform standards established in the APEX AO, and without comparison to other proposals.
- All evaluators are experts in the areas that they evaluate.
- Non-panelist/mail-in evaluators (to provide special science expertise to the Science Panels) and specialist evaluators (to provide special technical expertise to the TMC Panel) may be used, respectively, based on need for expertise in a specific science or technology/engineering area that is proposed.

Evaluation Criteria from APEX AO

A. Scientific Merit of the Proposed Investigation (Form A, AO Section 7.2.2)

B. Scientific Implementation Merit and Feasibility of the Proposed Investigation (Form B, AO Section 7.2.3)

C. TMC Feasibility of the Proposed Mission Implementation (Form C, AO Section 7.2.4)

Weighting: the first criterion is weighted approximately 40%; the second and third criteria are weighted approximately 30% each.

Other Selection Factors (Section 7.3)

- Programmatic factors
- PI-Managed Mission Cost

Science Evaluation

Science Panel Composition and Organization

- The Program Scientist leads the Science Panel.
- Science evaluators are typically, but not exclusively, recruited from the academic, governmental, and industrial research communities.
- The approach to evaluator identification is reviewed by the pre-evaluation Steering Committee convened by the DAAR (Pre-Evaluation - Steering Committee Meeting 1, page 13).
- The Science Panel evaluates the *Scientific Merit of the Proposed Investigation* (A Factors, AO Section 7.2.2) and the *Scientific Implementation Merit and Feasibility of the Proposed Investigation* (B Factors, AO Section 7.2.3).
- The science evaluation is conducted via one Science Panel; however, sub-panels may be employed, depending on the number and variety of proposed investigations.
  - Any sub-panel is led by a NASA Civil Servant and may be co-chaired by a member from the scientific community.
  - Sub-panels may have an Executive Secretary.
- Each proposal is evaluated by assigned panel members.
  - The Lead Evaluator for each proposal will lead the discussion. At least two secondary (supporting) evaluators are assigned to each proposal.
  - At the request of the Lead Reviewer, a Supporting Reviewer or the Executive Secretary, if available, will take notes on the discussion.
- The TMC Panel may provide comments and questions to the Science Panel, and vice versa.
- The Science Panel may request clarifications from proposers on any Potential Major Weaknesses (PMWs) that are identified on Forms A and B during the evaluation process.

Science Panel Procedures

- Science Panel evaluators will review a version of the proposal in which all export-controlled material has been redacted. Proposers are required to indicate such material; NRESS will redact the proposal pdf.
- Each Science Panel member evaluates proposals as directed by the Chair.
  - If special science expertise is required, the Science Panels may use non-panelist evaluators to assist with one or more proposals.
  - Non-panelist evaluators evaluate only those parts of proposals pertinent to their scientific/technological specialties.
- Each proposal may be discussed by the evaluators in web conferences.
  - Findings in the form of Strengths and Weaknesses form the basis for initial panel discussions.
  - Each assigned evaluator provides an individual evaluation prior to the web conferences.
  - During the web conference, the proposal and the individual evaluations, including those from non-panelist/mail-in evaluators, are discussed.
  - Following the web conferences, the Lead Evaluator captures/synthesizes individual evaluations including discussions and generates a Draft Evaluation Form including draft findings. Draft findings include PMWs to be sent to the proposers for clarification.
  - After PMW clarification responses are received, web conferences are held to consider clarification responses. Draft findings are updated if applicable.
  - No overall merit rating is assigned at the web conferences.

Science Panel Procedures (continued)

- A Meeting of the Science Panel or sub-panels is held upon completion of individual evaluations for all proposals.
  - The Science Panel (or sub-panel) compiles all of the findings for each proposal.
  - If the sub-panels meet separately, a web conference of the sub-panel chairs, or of sub-panel members explicitly tasked with consistency, will review the draft findings of all sub-panels for consistency ahead of the sub-panel meetings.
  - For each proposal, the Chair or designated Lead Evaluator leads the discussion, summarizes the proposed investigation, and documents the results.
  - After all sub-panels completed their draft evaluations, a plenary panel meeting will be held where the evaluations of all proposals are reviewed by all unconflicted science evaluators to ensure that standards have been applied uniformly and in an appropriate and fair manner.
  - After the discussion, each member of the Panel or sub-panel assigns a rating for Science Merit (Form A) and for Science Implementation and Feasibility (Form B) to each proposal. Non-panelist evaluators do not assign ratings.
  - The Lead Evaluator synthesizes and documents Panel evaluations.

Science Panel Evaluation Factors

Criterion A: Scientific Merit of the Proposed Investigation. This criterion assesses the intrinsic scientific merit of the proposed investigation. Scientific merit will be evaluated for the Baseline Science Investigation and the Threshold Science Investigation; Science Enhancement Options (SEOs) beyond the Baseline Science Investigation will not contribute to the assessment of the scientific merit of the proposed investigation. The factors for scientific merit include the following, where Factors A-1 and A-2 apply only to the PI-led investigation:

Factors from APEX AO, Section 7.2.2

- Factor A-1. Compelling nature and scientific priority of the proposed PI-led investigation's science goals and objectives..
- Factor A-2. Programmatic value of the proposed PI-led investigation.
- Factor A-3. Scientific value of the Threshold Science Investigation.
- Factor A-4. Compelling nature and scientific priority of any potential General Observer (GO) or Guest Investigator (GI) investigations.

Factors A-1, A-2, and A-4 are evaluated for the Baseline Science Investigation assuming it is implemented as proposed and achieves technical success. Factor A-3 is similarly evaluated for the Threshold Science Investigation. Factor A-4 is evaluated for GO/GI investigations enabled by the PI investigation and does not include any GO/GI that are enabled by an SEO science investigation.

Evaluation Criterion A

- **Factor A-1. Compelling nature and scientific priority of the proposed PI-led investigation's science goals and objectives.** This factor includes the clarity of the goals and objectives; how well the goals and objectives reflect program, Agency, and national priorities; the potential scientific impact of the investigation on program, Agency, and national science objectives; and the potential for fundamental progress, as well as filling gaps in our knowledge relative to the current state of the art.
- **Factor A-2. Programmatic value of the proposed PI-led investigation.** This factor includes the unique value of the investigation to make scientific progress in the context of other ongoing and planned missions; the relationship to the other elements of NASA's science programs; how well the investigation may synergistically support ongoing or planned missions by NASA and other agencies; and the necessity for a space mission to realize the goals and objectives.
- **Factor A-3. Scientific value of the Threshold Science Investigation.** This factor includes the scientific value of the Threshold Science Investigation using the standards in the first factor of this section and whether that value is sufficient to justify the proposed cost of the project. This factor should include the scientific value of the potential GO/GI science during a Threshold Science Investigation.
- **Factor A-4. Compelling nature and scientific priority of any potential General Observer or Guest Investigator investigations.** This factor includes the potential scientific impact of the GO/GI investigations on program, Agency, and national science objectives; and the potential for GO/GI investigations to make fundamental progress, as well as fill gaps in our knowledge relative to the current state of the art.

Science Panel Evaluation Factors

Criterion B: Scientific Implementation Merit and Feasibility of the Proposed Investigation. This criterion assesses merit of the plan for completing the proposed investigation, including the scientific implementation merit, feasibility, resiliency, and probability of scientific success of the proposed investigation. The factors for scientific implementation merit and feasibility include the following, where Factors B-1 through B-6 apply only to the PI-led investigation:

Factors from APEX AO, Section 7.2.3

- Factor B-1. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the science goals and the science objectives.
- Factor B-2. Probability of technical success.
- Factor B-3. Data adequacy, analysis and archiving.
- Factor B-4. Science resiliency.
- Factor B-5. Probability of science team success.
- Factor B-6. Merit of the Diversity and Inclusion Plan.
- Factor B-7. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the potential General Observer or Guest Investigator science.

The panel also provides comments to the Selection Official. While not considered in the evaluation, they may be considered during selection. Topics can include:

- **Career development opportunities to train the next generation of science leaders.**

Evaluation Criterion B

- **<u>Factor B-1</u>. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the science goals and the science objectives.** This factor includes how well the anticipated measurements support the goals and objectives; the appropriateness of the selected instruments and mission design for addressing the goals and objectives; and the appropriateness of the mission requirements for guiding development and ensuring scientific success.
- **<u>Factor B-2</u>. Probability of technical success.** This factor includes the maturity and technical readiness of the instruments or demonstration of a clear path to achieve necessary maturity; the adequacy of the plan to develop the instruments within the proposed cost and schedule; the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks; the likelihood of success in developing any new technology that represents an untested advance in the state of the art; the ability of the development team—both institutions and individuals—to successfully implement those plans; and the likelihood of success for both the development and the operation of the instruments within the mission design.

Evaluation Criterion B (continued)

- **<u>Factor B-3</u>. Data adequacy, analysis and archiving.** This factor includes the degree to which the proposed mission and instruments can provide the quality and quantity of data necessary to complete the investigation and meet the proposed science objectives. Additionally, it includes the merit of data analysis plans, including the fidelity of physical models required to connect the measurements to the science objectives; and plans for archiving, to preserve data and analysis of value to the science community. Considerations include planning and budget adequacy, with plans for well-documented, high-level data products and software usable to the entire science community; adequate resources for physical interpretation of data; reporting scientific results in the professional literature (*e.g.*, refereed scientific journals); and timely release of the data to the public domain.
- **<u>Factor B-4</u>. Science resiliency.** This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Science Investigation to the Threshold Science Investigation in the event that development problems force reductions in scope. Operational resiliency includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.

Evaluation Criterion B (continued)

- **Factor B-5. Probability of science team success.** This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well-defined and appropriate role may be cause for downgrading during evaluation.
- **Factor B-6. Merit of the Diversity and Inclusion Plan.** This factor includes an evaluation of the Diversity and Inclusion Plan. Individuals with practical and/or research experience in IDEA topics and the applications of IDEA principles will evaluate the Diversity and Inclusion Plan focusing on how executable and effective the Plan is expected to be.
- **Factor B-7. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the potential General Observer or Guest Investigator science.** This factor includes how well the anticipated measurements for the PI-led proposed science would demonstrate the capability of the Observatory to successfully perform the potential General Observer or Guest Investigator program.

The review of the merit of the Diversity and Inclusion Plan is led by individuals with practical and/or research experience in IDEA topics and the application of IDEA principles to teams.

Science Evaluation Products: Findings

- **Major Strength:** A facet of the implementation response that is judged to be of superior merit and can substantially contribute to the ability of the investigation to meet its scientific objectives.
- **Major Weakness:** A deficiency or set of deficiencies taken together that are judged to substantially weaken the investigation's ability to meet its scientific objectives.
- **Minor Strength:** An aspect of the proposal that is judged to contribute to the ability of the investigation to meet its scientific objectives.
- **Minor Weakness:** A deficiency or set of deficiencies taken together that are judged to weaken the investigation's ability to meet its scientific objectives.

Note: Findings that are considered "as expected" are not documented on Forms A and B.

Science Evaluation Grade Definitions

Excellent: A comprehensive, thorough, and compelling proposal of exceptional merit that fully responds to the objectives of the AO as documented by numerous and/or significant strengths and having no major weaknesses.

Very Good: A fully competent proposal of very high merit that fully responds to the objectives of the AO, whose strengths fully outbalance any weaknesses.

Good: A competent proposal that represents a credible response to the AO, having neither significant strengths nor weaknesses and/or whose strengths and weaknesses essentially balance.

Fair: A proposal that provides a nominal response to the AO, but whose weaknesses outweigh any perceived strengths.

Poor: A seriously flawed proposal having one or more major weaknesses (*e.g.*, an inadequate or flawed plan of research or lack of focus on the objectives of the AO).

Note: Only Major Findings are considered in the adjectival rating.

Science Evaluation Products

For each proposal, this process results in Form A and Form B, each of which includes:

- Proposal title, PI name, and submitting organization;
- Proposal summary;
- Based on findings, adjectival median rating for *Scientific Merit of the Proposed Investigation* (Form A) and for *Scientific Implementation Merit and Feasibility of the Proposed Investigation* (Form B), ranging from “Excellent” to “Poor”*; half-grades (*e.g.,* Very Good/Good) are permitted during polling;
  - If the median rating falls between two grades (*e.g.,* Very Good and Good), the median rating will be stated as a mid-point between the grades (*e.g.,* Very Good/Good)*;
- Summary rationale for the median rating;
- Narrative findings, identified as major or minor strengths or weaknesses; and
- Comments to the Proposers, comments to the Selection Official*, and comments to the TMC Panel* (optional)

*** Note: Not provided to proposers**

TMC Evaluation

TMC Panel Composition and Organization

- The Acquisition Manager, who is a Civil Servant in the NASA Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC), leads the TMC Panel.
  - NASA SOMA works directly for NASA Headquarters and is firewalled from the rest of NASA LaRC.
- TMC Panel evaluators are a mix of the best non-conflicted contractors, consultants, and Civil Servants who are subject matter experts in the areas of the proposals that they evaluate.
- The TMC Panel develops findings for each proposal that are based on individual comments and reflect the general agreement of the entire panel.
  - Comments that are *as expected* are not included as findings.
  - Comments that are *above expectations* result in strengths.
  - Comments that are *below expectations* result in weaknesses.
- Additionally, specialist evaluators may be called upon in cases where technical expertise is needed that is not represented on the panel.
  - Specialist Evaluators evaluate only those parts of a proposal that are specific to their particular expertise.
  - Specialist Evaluators provide only findings; they do not participate in polling on Form C.
- Consistency Review for Form C findings ensures similar findings are treated equivalently across different proposals.
- Only TMC evaluators who have participated in the TMC Plenary may participate in polling on Form C.

TMC Panel Evaluation Factors

Criterion C: TMC Feasibility of the Proposed Mission Implementation. Evaluating the technical and management approaches of all submitted investigations, this criterion assesses the likelihood that they can be successfully implemented as proposed, including an assessment of the likelihood of their completion within the proposed cost and schedule. The factors for feasibility of mission implementation include the following:

Factors from APEX AO, Section 7.2.4

- Factor C-1. Adequacy and robustness of the instrument implementation plan.
- Factor C-2. Adequacy and robustness of the mission design and plan for mission operations.
- Factor C-3. Adequacy and robustness of the flight systems.
- Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team.
- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk.

The panel also provides comments to the Selection Official. While not considered in the evaluation, they may be considered during selection. Topics can include:

- **Size and nature of contributions,**
- **Fraction of PIMMC expended before KDP-C,**
- **Career development opportunities to train the next generation of engineering and management leaders.**
- **For APEX this may include appropriateness of the allocation of the additional data volume proposed for the potential GO data.**

Evaluation Criterion C

- **Factor C-1. Adequacy and robustness of the instrument implementation plan.** The maturity and technical readiness of the instrument complement will be assessed, as will the ability of the instruments to meet Investigation requirements. This factor includes an assessment of the instrument design, accommodation, interface, heritage, and technology readiness. This factor includes an assessment of the instrument hardware and software designs, heritage, and margins. This factor includes an assessment of the processes, products, and activities required to accomplish development and integration of the instrument complement. This factor also includes adequacy of the plans for instrument systems engineering and for dealing with environmental concerns. This factor includes an assessment of plans for the development and use of new instrument technology and plans for advanced engineering developments to mature systems within the proposed cost and schedule when systems having a TRL less than 6 are proposed.
- **Factor C-2. Adequacy and robustness of the mission design and plan for mission operations.** This factor includes an assessment of the overall mission design and mission architecture, the spacecraft design and design margins (including margins for launch mass, delta-v, and propellant), the concept for mission operations (including communication), and the plans for launch services. This factor includes mission resiliency—the flexibility to recover from problems during both development and operations—including the technical resource reserves and margins, system and subsystem redundancy, and reductions and other changes that can be implemented without impact to the Baseline Science Investigation.

Note: Specifics of the ground systems will be evaluated at Step 2 under Factor C-7 (see the *Criteria and Requirements for the Phase A Concept Study* document).

Evaluation Criterion C

- **<u>Factor C-3</u>. Adequacy and robustness of the flight systems.** This factor includes an assessment of the flight hardware and software designs, heritage, and margins. This factor includes an assessment of the plans, products, and activities required to accomplish maturation, development, integration, and verification of all elements of the flight system. This factor includes an assessment of the adequacy of all elements of flight system resiliency, including flight software/hardware fault management, system and subsystem redundancy, and hardware reliability. This factor includes the plans for the development and use of new technology, plans for advanced engineering developments, and the adequacy of those plans to ensure success of the investigation when systems having a TRL less than 6 are proposed. The maturity and technical readiness of the spacecraft, and subsystems will be assessed.

Evaluation Criterion C

- **<u>Factor C-4</u>. Adequacy and robustness of the management approach and schedule, including the capability of the management team.** This factor includes: the adequacy of the proposed organizational structure; the management approach including the roles; the commitment, qualifications, and experience of any named Key Management Team members, the implementing organization, and the known partners; the spaceflight experience of any named Key Management Team members; the implementing organization and known partners against the needs of the investigation; the prior working relationships of the implementing organization and known partners; the commitments of partners and contributors; and the scope of work covering all elements of the project, including contributions. Also evaluated under this factor is the adequacy of the proposed risk management approach, including any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities. The management of the risk of contributed critical goods and services will be assessed, including the plans for any international participation, the commitment of partners and contributors, as documented in Letters of Commitment, and the technical adequacy of contingency plans, where they exist, for coping with the failure of a proposed cooperative arrangement or contribution. This factor also includes assessment of elements such as the relationship of the work to the project schedule, the project element interdependencies, the associated schedule margins, and an assessment of the likelihood of meeting the proposed launch readiness date.

Evaluation Criterion C

- **<u>Factor C-5</u>. Adequacy and robustness of the cost plan, including cost feasibility and cost risk.** This factor includes elements such as cost, cost risk, cost realism, and cost completeness including assessment of the basis of estimate, the adequacy of the approach used to develop the estimated cost, the discussion of cost risks, the adequacy and allocation of cost reserves by phase, and the scope of work (covering all elements of the mission, including contributions). The adequacy of the cost reserves and understanding of the cost risks will be assessed. This factor also includes an assessment of the proposed cost relative to estimates generated by the evaluation team using parametric models and analogies.

TMC Cost Evaluation

- The evaluation assesses the cost risk, cost realism, and cost completeness including the basis of estimate, the adequacy of the approach used to develop the estimated cost, the discussion of cost risks, the adequacy and allocation of cost reserves by phase, and the scope of work (covering all elements of the mission).
- An independent cost verification of the proposed cost for Phases A-D is performed using at least two independent cost models.
- An independent cost verification of the proposed cost for Phase E is performed using at least one cost model.
- The likelihood and cost impact of major weaknesses is assessed.
- Cost threat impacts to the proposed unencumbered cost reserves are assessed.
- The adequacy of the remaining unencumbered cost reserves is assessed.
- All draft Forms C and Cost Evaluation Summaries (CESs) are completed prior to the Plenary Meeting.
- The entire panel participates in the Cost deliberations.
- All information from the entire evaluation process is considered in the final cost assessment.
- All cost findings are included on the Form C and considered in the TMC Risk Rating.

Cost Threat Matrix

- The *likelihood* and *cost impact*, if any, of each weakness is stated as "This finding represents a cost threat assessed to have an Unlikely/Possible/Likely/Very Likely/Almost Certain likelihood of a Minimal/Limited/ Moderate/Significant/Very Significant cost impact being realized during development and/or operations, which results in a reduction from the proposed unencumbered reserves."
- The *likelihood* is the probability range that the *cost impact* will materialize.
- The *cost impact* is the current best estimate of the range of costs to mitigate the threat.
- The cost threat matrix defines the adjectives that describe the *likelihood* and *cost impact*.
- The minimum cost threat threshold is $2M for Phases B/C/D *and $1M for Phase E*.

				Cost Impact (CI) **% of PI-Managed Mission Cost to complete Phases B/C/D or *% of Phase E* not including unencumbered cost reserves or contributions**				
	Likelihood of Occurrence	**Weakness**	**Very Minimal** $2M < CI ≤ 2.5% *$1M < CI < 2.5%*	**Minimal** 2.5% < CI ≤ 5% *2.5% < CI ≤ 5%*	**Limited** 5% < CI ≤ 10% *5% < CI ≤ 10%*	**Moderate** 10% < CI ≤ 15% *10% < CI ≤ 15%*	**Significant** 15% < CI ≤ 20% *15% < CI ≤ 20%*	**Very Significant** CI > 20% *CI > 20%*
Likelihood (L, %)	Almost Certain (L > 80%)							
	Very Likely (60% < L ≤ 80%)							
	Likely (40% < L ≤ 60%)							
	Possible (20% < L ≤ 40%)							
	Unlikely (L ≤ 20%)							

Note: For each proposal, the percentages in the above table will be converted to dollars by the cost estimator depending on the proposed PIMMC.

TMC Evaluation Products: Findings

- **Major Strength:** A facet of the implementation response that is judged to be well above expectations and can substantially contribute to the ability of the project to meet its technical requirements on schedule and within cost.
- **Major Weakness:** A deficiency or set of deficiencies taken together that are judged to substantially weaken the project's ability to meet its technical objectives on schedule and within cost.
- **Minor Strength:** A strength that is worthy of note and can be brought to the attention of Proposers during debriefings, but *is not a discriminator in the assessment of risk*.
- **Minor Weakness:** A weakness that is sufficiently worrisome to note and can be brought to the attention of Proposers during debriefings, but *is not a discriminator in the assessment of risk*.

Note: Findings that are considered "as expected" are not documented on the Form C.

TMC Evaluation Products: Risk Ratings

Based on the narrative findings, each proposal will be assigned one of three risk ratings, defined as follows:

Low Risk: There are no problems evident in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the proposer's capability to accomplish the investigation well within the available resources.

Medium Risk: Problems have been identified, but are considered within the proposal team's capabilities to correct within available resources with good management and application of effective engineering resources. Investigation design may be complex and resources tight.

High Risk: One or more problems are of sufficient magnitude and complexity as to be deemed unsolvable within the available resources.

Note: Only Major findings are considered in the risk rating.

TMC Panel Product: Form C

For each proposal, the TMC Evaluation will result in a Form C for Categorization, Steering, and Selection that contains:

- Proposal title, PI name, and submitting organization;
- Based on the findings, an adjectival median risk rating for the TMC Feasibility of the Proposed Mission Implementation of “Low Risk,” “Medium Risk” or “High Risk”;
  - A median score that falls between two risk ratings will be “rounded” to the higher risk rating.
- Summary rationale for the median risk rating;
- Narrative findings, identified as major or minor strengths or weaknesses; and
- Comments to the Proposers, comments to the Selection Official*, and comments to the Science Panel* (optional).

*** Note: Not provided to proposers.**

Potential Major Weakness (PMW) Clarifications Process

PMW Clarifications Process

Section 7.1.1 of the AO states “Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer’s response must be in writing.”

In particular, before finalizing the proposal evaluation NASA will request clarification on potential major weaknesses (PMWs) in the A, B, and C factors that have been identified in the proposal.

PIs whose proposals have no PMWs will be informed that no PMWs have been identified.

All PIs are allowed the same number of pages for Clarifications, including those who have no PMWs.

The full set of clarification responses to the factors above will be considered by the Science Panel and the Technical Management and Cost (TMC) panel. Only the responses will be provided to the other panel but not the PMWs.

Proposers will have at least 48 hours to respond.

Clarification Process Requirements (1 of 3)

Clarifications Responses must conform to the following requirements:

Requirement 1: The clarification response shall consist of two documents: one Clarification Response Document that addresses the PMWs for the A and B factors (combined), and one Clarification Response Document that addresses the PMWs for the C-factors.

Requirement 2: Each Clarification Response Document shall be a single unlocked (*e.g.*, without digital signatures) searchable Adobe Portable Document Format (PDF) file, composed of the response text, figures, and/or tables. Images (*e.g.*, figures and scans) shall be converted into machine-encoded text using optical character recognition. Animations shall not be included. Links to materials outside of the response are not permitted. Comment fields shall not be inserted.

Requirement 3: The Clarification Response Documents shall be presented in 8.5 x 11 inch paper (or A4). Text shall not exceed 5.5 lines per vertical inch and page numbers shall be specified. Margins at the top, both sides, and bottom of each page shall be no less than 1 inch if formatted for 8.5 x 11 inch paper; no less than 2.5 cm at the top and both sides, and 4 cm at the bottom if formatted for A4 paper. Type fonts for text, tables, and figure captions shall be no smaller than 12-point (*i.e.*, no more than 15 characters per horizontal inch; six characters per horizontal centimeter). Fonts used within figures shall be no smaller than 8-point.

Requirement 4: For the A- and B-factors PMWs combined, the Clarification Response Documents shall not exceed eight pages. For the C-factor PMWs, the Clarification Response Documents shall not exceed six pages. Text, table(s) and figure(s) are permitted; however, all material shall be within the page limits specified above and shall abide by limitations in Requirements 2, 3 and 9. Each response file shall not exceed 10MB.

Clarification Process Requirements (2 of 3)

Requirement 5: The Clarification Response Documents shall not contain International Traffic in Arms Regulations (ITAR), Export Administration Regulations (EAR), or classified material.

Requirement 6: The Clarification Response Documents shall label each PMW response with the PMW number provided. Each PMW clarification response shall contain only information specific to the PMW. A clarification response may point back to references in the proposal; however, PMWs' references to locations in the proposal indicate that they have already been evaluated and a re-reference alone does not obligate a re-consideration of those data. References to proposal material is expected to use the proposal section numbers and page number on the proposal page (as opposed to the electronic PDF file page number).

Requirement 7: The Clarification Response Document may include additional information on any criteria or requirements relevant to the proposed investigation (*e.g.,* for TMC Feasibility of the Proposed Investigation Implementation, advances in proposed technologies since proposal submission). However, this additional information counts against the total page limitation for the Clarification Response Document that contains it.

Requirement 8: The Clarification Response Document shall not include more than two new references in support of any single PMW clarification response or of any single additional information response. All references shall be to peer-reviewed literature, or to full conference proceeding papers (not just abstracts) that are published and accessible. References included in the proposal do not constitute new references. References shall be restricted to those with a publication or release date before the PMW sent date.

Clarification Process Requirements (3 of 3)

Requirement 9: The clarification response may include, outside the two Clarification Response Documents, complete versions of a modified Science Traceability Matrix (STM; Table B1), Mission Traceability Matrix (MTM; Table B2), Total Mission Cost Profile table (Table B3 in Excel format), Master Equipment List (MEL; Table B5 in Excel format), and/or schedule foldout (AO Requirements B-49) and associated table of dates (AO Requirement B-50 in Excel format). These modified fold-out(s)/table(s) shall have modifications clearly marked by the use of a different color font or by a colored-bordered box (labeled “PMW Clarification”). The page-limited Clarification Response Documents shall provide the description of the updates and changes to the modified fold-out(s)/table(s) as text. The complete versions of the modified STM, MTM, Total Mission Cost Profile table, MEL and schedule will not count against the page limit. Any new or other fold-out(s) will each count as two pages against the response page limit.

Categorization, Steering and Selection

Categorization Process and Proposal Categories

Subsequent to the evaluation process, NASA will convene a Categorization Committee, composed wholly of Civil Servants and IPA appointees (some of whom may be from Government agencies other than NASA) and appointed by the Deputy Associate Administrator for Research for the Science Mission Directorate. The Categorization Committee will consider the Scientific Merit, Scientific Implementation Merit and Feasibility, TMC Feasibility of the Proposed Mission Implementation and Programmatic Value of the Investigation, and, based on the evaluations, categorize the proposals in accordance with procedures required by NFS 1872.404. The categories are defined in NFS 1872.404(k) as follows:

Category I. Well-conceived, meritorious, and feasible investigations pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II. Well-conceived, meritorious, and feasible investigations that are recommended for acceptance, but at a lower priority than Category I, whatever the reason.

Category III. Meritorious investigations that require further development. Category III investigations may be funded for further development and may be reconsidered at a later time for the same or other opportunities.

Category IV. Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

Evaluation Conclusion and Steering Committee

- Once Categorization has been completed, the Evaluation is considered complete unless any issue is questioned by a subsequent AO Steering Committee review.
- NASA will convene a Steering Committee, composed wholly of CS and IPA appointees (some of whom may be from Government agencies other than NASA), appointed by the Associate Administrator for the Science Mission Directorate.
- The Steering Committee will then review the results of the evaluations and categorizations.
- The Steering Committee conducts an independent assessment of the evaluation and categorization processes regarding their compliance to established policies and practices, as well as the completeness, self-consistency, and adequacy of all supporting materials.

Selection Process

- After the review by the Steering Committee, the sponsoring Division prepares one or more options for the selection decision.
- The sponsoring Division presents the final evaluation results and its selection recommendation to the Associate Administrator for the Science Mission Directorate, who will make the final selection(s).
- As the Selection Official, the SMD Associate Administrator may consult with senior members of SMD and the Agency concerning the selections.
- As part of the selection process, a decision will be made as to whether any Category III proposals will receive funding for technology development.

Selection Factors

A full discussion of the factors considered in the selection process can be found in AO Section 7.3. This includes the following.

- The Selection Official may consider a wide range of programmatic factors in deciding whether to select any proposals and in selecting among top-rated proposals, including, but not limited to, planning and policy considerations, available funding, career development opportunities, programmatic merit and risk of any proposed partnerships, and maintaining a programmatic and scientific balance across SMD.
- The overriding consideration for the selection of proposals submitted in response to this AO will be to maximize scientific value (which considers both science return and risk) while advancing NASA's science goals and objectives within the available budget for this program.

Observers

Observers Approval and Compliance

Civil Servants, IPAs, and/or contractors with downstream implementation responsibilities may attend panel meetings as Observers.

- Observer participation must be approved by the Program Scientist and the Deputy Associate Administrator for Research.
- Observers must comply with SMD Policy Document SPD-17, Statement of Policy on Observers at Panel Reviews of Proposals. This policy is provided to all approved observers who have implementation responsibilities.

Approvals

Approval

Mr. Victor Lucas
Acquisition Manager
Science Office for Mission Assessments

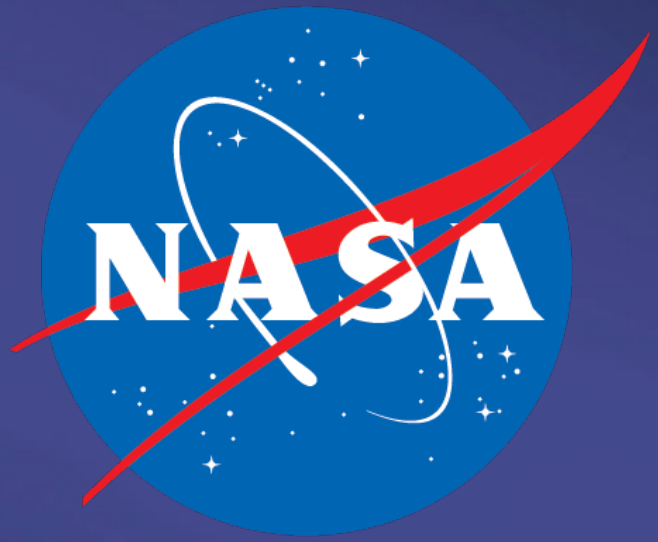
Dr. Cindy Daniels
Director
Science Office for Mission Assessments

Dr. Patricia Knezek
Program Scientist
Astrophysics Division, SMD

Dr. Mark Clampin
Director
Astrophysics Division, SMD

Dr. Michael New
Deputy Associate Administrator for Research, SMD

Electronically approved copy on file


NASA